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Safe administration of transdermal medications: a systematic literature review

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Abstract

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Safe administration of transdermal medications: a systematic literature review

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The thesis belongs to the Triangle Hospital project in the Meilahti hospital area in the Hospital district of Helsinki and Uusimaa (HUS). One of the challenges in the new hospital was patient information and safe medication. Transdermal medication has shown to have clinical benefit and high-level patient acceptability.

The purpose of this study was to describe the guidance of transdermal medications on patients who need chronic pain management on the bases of a literature review. The research question is: How is the guidance of transdermal medications described for patients who need chronic pain management on the bases of the literature review?

The method of the review was qualitative research. Systematic literature review was used in data collection, and inductive qualitative content analysis was used in the interpretation of data.

Two major categories were identified from the content of the data. The first category was staff and patient education in the administration of transdermal medications; the subcategories were indications for transdermal medication administration, planning its administration, assessment of the transdermal medication use, documentation of the administration, staff education for the administration and patient guidance of transdermal medication use. The second category was risks in the administration of transdermal medications; the subcategories were medication errors by patients in the use of transdermal medications, overdose and abuse of transdermal fentanyl, and prevention of medication errors by prescribers in administration of transdermal medication. The review of the literature revealed that there is a need for pain management that is easy for patients to use, gives continuous pain relief and has minimal side-effects. On the other hand transdermal route medication has the potential for patient harm if used inappropriately. It was also noted that there is not enough patient guidance available. More research is required on safe administration and patient guidance of transdermal medications.

Nurses are the front-line providers in patient education. They have the important role in reducing errors by communicating and documenting the use of transdermal medication and by knowing the indications of the medication. Patient guidance could be developed further by developing a written form to be given to patients. The guidance could be about potency and dose of the medication, as well as the application, removal and disposal of the transdermal patch.

Keywords Patient guidance, safe medication, transdermal medications, chronic pain management

Laurea-ammattikorkeakoulu
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Tiivistelmä

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Lääkelaastareiden turvallinen käyttö: systemaattinen kirjallisuuskatsaus

Vuosi 2011 Sivumäärä 24

Opinnäytetyö kuuluu Kolmiosairaala -hankkeeseen Meilahden sairaala-alueella Helsingin ja Uudenmaan sairaanhoitopiirissä (HUS). Yksi uuden sairaalan haasteista oli potilastiedoitus ja turvallinen lääkitys. Lääkelaastarit ovat osoittautuneet kliinisesti sopiviksi ja potilaat ovat hyväksyneet ne yleisesti.

Tämän opinnäytetyön tarkoitus oli kuvailla lääkelaastareiden käytön ohjausta potilailla, jotka tarvitsevat kroonisen kivun hallintaa systemaattisen kirjallisuuskatsauksen perusteella. Tutkimuskysymys oli: Miten lääkelaastareiden käytön ohjausta kuvaillaan potilailla, jotka tarvitsevat kroonisen kivun hallintaa systemaattisen kirjallisuuskatsauksen perusteella?

Kirjallisuuskatsaus tehtiin laadullista tutkimusta käyttäen. Tiedonkeruu tehtiin systemaattisen kirjallisuuskatsauksen pohjalta ja sisällön analysointi tehtiin laadullisen induktiivisen sisällön analysoinnin avulla.

Kaksi kategoriaa löytyi materiaalin sisällöstä. Ensimmäinen kategoria oli henkilökunnan ja potilaiden ohjaus lääkelaastareiden käytössä; alakategoriat olivat lääkelaastareiden käytön indikaatiot, lääkelaastareiden käytön suunnittelu, lääkelaastareiden käytön kirjaaminen, henkilökunnan kouluttaminen lääkelaastareiden käyttöön ja potilaiden ohjaus lääkelaastareiden käytössä. Toinen kategoria oli lääkelaastareiden käytön riskit; alakategoriat olivat potilaiden tekemät virheet lääkelaastareiden käytössä, fentanyl laastareiden yliannostus ja väärinkäyttö ja lääkelaastareiden määrääjien virheiden ehkäiseminen. Kirjallisuuskatsaus ilmaisee, että on olemassa tarve kivun hallintaan, joka on potilaille helppoa, antaa jatkuvaa kivun lievitystä ja jolla on minimaaliset sivuvaikutukset. Toisaalta lääkelaastarit aiheuttavat vahinkoa potilaille, jos niitä käytetään väärin. Ilmeni myös, että potilaille ei anneta tarpeeksi ohjausta lääkelaastareiden turvallisesta käytöstä. Turvallinen lääkelaastareiden käyttö ja potilaiden ohjaus vaativat vielä lisää tutukimustyötä.

Sairaanhoitajat ovat etulinjassa potilaiden ohjauksessa. Heillä on tarkeä rooli virheiden vähentämisessä keskustelemalla ja kirjaamalla lääkelaastareiden käytön ja tietämällä lääkkeen indikaatiot. Potilasohjausta voisi kehittää edelleen luomalla kirjallista tiedoitusta potilaille. Ohjaus voisi sisältää tietoa lääkkeen vahvuudesta ja annostelusta, kuten myös lääkelaastarin asentamisesta, poistamisesta ja hävittämisestä.

Asiasanat: potilasohjaus, turvallinen lääkitys, lääkelaastarit, kroonisen kivun hoito

Contents

1 Introduction

The thesis belongs to the Triangle Hospital project in the Meilahti hospital area which is specialised for internal medicine with a total of 210 patient beds, out patient department and day hospital. The hospital was opened in 2010. The Triangle Hospital project is a part of HUS's and Laurea University of Applied Sciences' collaboration. One of the challenges in the new hospital is patient information and safe medication. The aim of the project is to develop guidance and information service in the Triangle Hospital.
(www.laurea.fi/optima/hankefoorumi)

In February 2010 there was a medical demonstrator visiting a hospital ward in Espoo. She introduced a new transdermal patch for the nursing staff. She told about Norspan (buprenorfin) 5 mcg, 10 mcg and 20 mcg. Norspan is good for long term pain management when paracetamol and anti-inflammatory drugs are not enough. One patch is applied every 7 days instead of 24 hours like in the case of the older types of patches. In the discussion afterwards the nurses pointed out some problems concerning the administration of transdermal patches in hospital environment. For example, they told about a case when a patient came to the hospital with several patches on the body and an other case when a nurse did not see a previous patch and applied a new one. The same problem areas would be considered in the administration of transdermal route medications at home environment.

A transdermal patch is a small, adhesive-backed patch that is attached to the skin. It contains a specific time-released medicine in a waterproof gel that passes through the epidermis into the blood vessels in the dermis. Epidermis is the outer layer of the skin. It contains no blood vessels, but most of it is so thin that even minor cuts reach the dermis and draw blood. Dermis is a strong, flexible connective tissue meshwork of collagenous, reticular, and elastic fibers. Blood vessels, lymphatic vessels, nerve endings, hair follicles, and glands are present in the dermis. Although the skin is almost waterproof and is solid enough to keep out the water, it is also porous enough to allow some chemicals in; both harmful substances and therapeutic medicines. (Van Wynsberghe, Noback & Carola 1995, 133,138)

"Transdermal patches are polymeric formulations which when applied to skin deliver the drug at a predetermined rate across dermis to achieve systemic effects. Transdermal dosage forms, though a costly alternative to conventional formulations, are becoming popular because of their unique advantages. Controlled absorption, more uniform plasma levels, improved bioavailability, reduced side-effects, painless and simple application and flexibility of terminating drug administration by simply removing the patch from the skin are some of the potential advantages of transdermal drug delivery" (Aggarwal, 2009).

The principle conclusions suggested by the results are that there is a need for pain management that is easy for patients to use, give continuous pain relief and has minimal side-effects. Transdermal route medication has clinical benefit and high–level patient acceptability. But it has the potential for significant patient harm if used inappropriately. Nurses are the front-line providers in patient guidance and safety. The misuse of transdermal medications have resulted in medication errors and abuse of the medications. Transdermal route medications can also be prescribed inappropriately (Cranwell-Bruce 2007, 333 and Grissinger 2010, 653)

2 Purpose of the study and research question

The purpose of the thesis is to describe the guidance of transdermal route medications for patients who need chronic pain management on the bases of the literature review. One of the visions of Triangle Hospital is to support patient's participation in his/her own active care. On the other hand one of the challenges in the new hospital is patient information and safe medication. The pertinent literature concerning transdermal route medications is reviewed in Appendices Tables 3 and 4.

The research question is: How is the guidance of transdermal route medications described for patients who need chronic pain management on the bases of the literature review?

The method of the study is qualitative research. Systematic literature review is used in data collection, and qualitative content analysis is used in the interpretation of data.

3 Systematic literature review

The research method in this study was qualitative approach which consist an investigation that seeks answers to the research question. Qualitative research aims to gather an in-depth understanding of human behaviour and the reasons that influence such behaviour. Scharalda & Leonard (2010, 613) write that qualitative research methods are usually used when little is known about the topic. It allows the researcher to explore the topic; the meanings and interpretations can be explored.

Systematic literature review is research that summarizes the evidence on a clearly formulated question using systematic and explicit methods to identify, select and appraise relevant studies, and to extract, collate and report their findings. (Khan, Kunz, Kleijnen & Antes 2003, 132) Systematic literature review was used in the data collection in this study. Literature search was systematic search of published articles, journals and research reports that were relevant to the thesis. According to Silverman (2000, 226-231) literature review combines knowledge and critical thought. Literature review can be defined as a selection of available

documents on the topic, which are information, ideas, data and evidence written from a particular standpoint to fulfil certain aims or express certain views. Literature review gives answers about what is already known about the topic, where does this work fit in what has been done before, and why this research worth doing in the light of what is has already been done.

Systematic literature review can be divided into three parts. First part includes the planning phase of the review. 1-3 clear research questions appear in the plan. After the research questions have been set the methodology of the review is chosen. The methodology includes the selection of the databases and research terms. In the second phase the data is screened and the relevant articles are chosen. The included articles are analysed considering the criteria for inclusion and exclusion. In the last phase the data of the study is analysed and the conclusions and possible recommendations are done in the discussion of the review. (Johansson, Axelin, Stolt & Ääri, 2007, 5-7)

The reason why qualitative research was chosen as a method for this thesis was to understand how and why the findings were achieved not only what was achieved. Literature review as a method allowed the reader to become updated with current knowledge on the topic. It also gave a basis for possible future research.

3.1 Data

The databases were selected from publications of health journals. The process includes literature search, screening and selection of data, and data analysis. The databases used in this study were: EBSCO (CINAHL), EBSCO (Academic Search Elite), Elsevier Science Direct, Ovid (Medline), Medic and Pubmed.

3.1.1 Data screening and selection

At step 1 (Figure 1) the titles and/or abstracts were analysed for relevance of the study according to the research task. In the search the operators OR and AND were used, and the terms were" Pain management", "Transdermal route medication", "Patient education" and "Transdermal patch" . The first search combining "Pain management" OR "Transdermal route medication" retrieved all citations where either one or both terms were found. The citation set was too large with combined result of 102 348 hits. After several sets of terms the search term combination "Transdermal patch" AND ""Patient education" turned out to be the most useful. The number of search results was manageable and they were from most of the selected databases. The combined result for the search was 120 potential articles, but only 10 of the articles were included in the literature review (Table 1). The 10 articles were saved in "Nelli" and they were also printed to allow closer reading and inspection.

At step 2 (Figure 1) the titles and/or abstracts of the 120 potential articles were studied carefully. The inclusion and exclusion criteria were applied (Table 2). The study selection criteria were that the searched material was relevant to the research task, and that the full text articles were available. Time limitation of the year of the publication was not used because the number of relevant articles was limited. Nevertheless all the pertinent articles considering transdermal medications were published during the last ten years. The articles in other than English language were excluded. The articles had to be about pain management. Many articles had information about other forms of medications like nicotine, hormone replacement therapy and glycerol trinitrate in the prophylaxis of angina. After the data screening ten articles were included in the literature review. The significance of the articles for this literature review was assessed. The articles were summarised narratively and thematically. The included 10 articles are listed in Appendices in Tables 3 and 4. The significance of the 10 articles for this literature review was narrated. The articles were listed in the order of the significance, not in the alphabetical order. In most of the included articles "transdermal patch" was used instead of "transdermal route medication". For that reason the term "Transdermal patch" was used in the search. "Patient education" turned out to be more used term than "patient guidance". In the text of the literature review the terms "transdermal medication" and "transdermal patch"; "patient education" and "patient guidance" were used collaterally.

Database	"Pain management" OR "Transdermal route medication"	"Transdermal route medication" AND "Patient education"	"Transdermal patch" AND "Patient education" AND "Pain management"	"Transdermal patch" AND "Pain management"	"Transdermal patch" AND "Patient education"
EBSCO (CINAHL)	41617	0	0	7	12
EBSCO (Academic Search Elite)	10517	0	11	54	27
Elsevier Science Direct	25479	0	15	238	68
Ovid (MEDLINE)	8531	0	0	5	6
Medic	4	0	0	0	0
Pubmed	16200	33	0	5	7
Combined results	102348	33	26	309	120

Table 1: Table 1 shows the literature search results with the number of hits using five different sets of terms.

Inclusion	Exclusion
Studies that were relevant to the research task	Studies that were not relevant to the research task
Studies that were available in full text	Studies that were not available in full text
Studies in English	Studies not in English

Table 2: Inclusion and Exclusion criteria

3.2 Data analysis

The types of data were published articles, journals and research reports. Qualitative content analysis method was used in the interpretation of data. Flick (2002, 190) writes that content analysis is one of the classical procedures for analysing text. One of the essential materials is the use of categories, and the goal is to reduce the material. According to Silverman in qualitative research the aim is to understand categories. The researchers are more concerned with the processes through which texts depict 'reality' than with whether such texts contain true or false statements. Data analysis consists of three concurrent flows of activity. Data reduction is the process of selecting, focusing, simplifying, abstracting and transforming data. Data display is an organized assembly of information that permits conclusion drawing (Silverman 2000, 128-142).

After the abstracts and findings of the potential articles were screened, the 10 articles which fulfilled the inclusion criteria (Table 2) were included in the literature review. At step 3 (Figure1) the data was analyzed by listing the relevant sentences. The method was induction which moved from the specific information to the general forming larger categories. After listing the content of the included ten articles, the content was categorized under titles so that the categories included similar factors. Two major categories were identified from the content: Staff and patient guidance in the administration of transdermal medications and Risks in the administration of transdermal medications. At step 4 (Figure 1) the findings of the included 10 articles were interpreted and categorized under the sub-categories in Findings of the study.

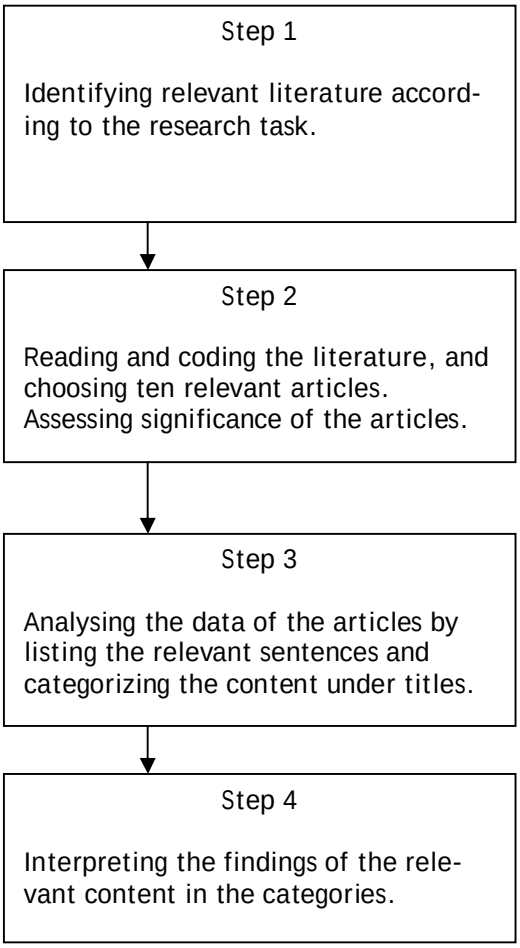

Figure 1: Shows the step-by-step explanation of the process for writing the literature review.

4 Findings of the study

4.1 Staff and patient education in the administration of transdermal medications

4.1.1 Indications for transdermal medication administration

It was noted in the literature that pain was one of the most important issues in health care. It was also noted that every year over 50 million people experienced chronic pain. Pain accounted for more disability than cancer and heart disease and accounted over $ 60 billion in lost productivity each year. Poor management of pain was linked to reduced patient satisfaction, increased economic burden, and reflected in the length of hospital stay and number of readmissions for the treatment of uncontrolled pain. It was noted as well that there was a need for pain management methods that were easy for patients to use, gave continuous pain relief, and had minimal side-effects.

Transdermal administration of medication was becoming a useful alternative to oral medication. Potent opioid in fentanyl patch was intended for time-released transdermal medication delivery. Fentanyl in a transdermal patch released medication slowly over a 72 –hour period to manage chronic moderate-to severe pain. Transdermal patches allowed the medication to be continuously absorbed through the skin and into the systemic circulation. Also buprenorphine was studied in a transdermal delivery system for management of severe cancer pain and chronic non-cancer pain. Buprenorphine was an attractive first-choice opioid for the treatment of acute and chronic pain, it was a partial mu receptor agonist. Buprenorphine was available in parenteral, sublingual tablets, sublingual solution and transdermal formulations. Buprenorphine therapy could be used for chronic noncancer pain like osteoarthritis pain.

4.1.2 Planning the transdermal medication administration

When gathering a medication history a nurse's questions may make a big difference with regard to whether transdermal patched were discovered. It was important to communicate and document the use of patches. The nurses took a detailed medication history including allergies, adverse effects and side-effects of past medications. Asking which medication worked or did not work in the past was important.

Nurses also provided adequate patient education by taking a careful history, which could help to prevent many problems with medications. It was also important to become familiar with the different doses available and nomenclature issues (a system of names). When patients had patches which contain traces of metal there was the potential for serious burns when they underwent magnetic resonance imaging (MRI): it was recommended to remove the patch

prior MRI. It was helpful to have a list of transdermal patches that were known to contain metal.

It was noted that in terminal care good pain control needed effective dosing and careful choice of analgesic, and awareness of the importance of changing disease. It was also noted that there was a need to actively involve both patients and carers in the management of symptoms. Transdermal analgesia was an effective method of analgesic delivery where the patient's pain was stable and opioid responsive. It was especially useful when there were side-effects to oral morphine, when the patient was unable to swallow or in situations where the administration of medication was unreliable. Although controlled-release medications had positive effects on patients, such as improved sleep, ability to participate in rehabilitation and enhanced pain management, their longer half-life means more toxicity in overdoses. A review of the literature revealed multiple problems with overdose and abuse since the fentanyl patch became available.

4.1.3 Assessment of the transdermal medication use

Pain became known as "the 5th vital sign". To rate the pain level became a routine part of assessment. It was noted that performing a complete skin assessment prior applying a transdermal opiate and to question the patients if they had a patch before was a good rule to perform. It was also important to assess the concomitant use of opioids. Health care practitioners should recognize the signs of fentanyl overdose – respiratory distress; shallow breathing; tiredness, extreme sleepiness, or sedation; an inability to think, talk, or walk normally; and feeling faint, dizzy, or confused.

Patients with life-limiting illness experienced symptoms that could cause discomfort and distress. Awareness of the importance of advancing or changing disease was needed, and that good pain control needed adequate assessment and regular review. About half of the patients who had cancer pain experienced pain that was inadequately controlled. Inadequate pain assessment, under-dosing of medication, failure to educate and monitor patients, and failure of the medication to relieve pain were likely to cause distress.

4.1.4 Documentation of the transdermal medication administration

In many facilities the application including location and the removal of the patch were documented onto the medication administration record (MAR). A new clinical practice process was initiated to improve medication administration record documentation to ensure patient safety. The process included all transdermal patch preparations. MAR had an entry were nurses can document the location of the patch, time of administration, and when the next

patch was due. The integrity and adhesion of the patch were checked and documented during each shift in MAR.

4.1.5 Staff education for the transdermal medication administration

The Food and Drug Administration in the USA issued a Public Health Advisory in 2005 warning practitioners to use safety information sheets and teach patient precautions, including signs and symptoms of overdose, techniques for applying the patches, and use of other medications while using the patches.

Nurses can reduce errors by routinely asking patients if they had a patch. Asking about transdermal patches is as important as asking about over-the-counter medications. Communicating and documenting the use of patches, removing patches containing metal prior to use of MRI, carefully discarding used patches, and educating patients about the safe use at home also reduce medication errors.

Health care practitioners needed to be aware that many transdermal patches often had a significant amount of active medication remaining after removal. Therefore appropriate disposal of the patch was important. Staff was educated to fold transdermal patches onto themselves and disposing them in protected sharp containers. In order to promote medication safety mandatory patient education could be beneficial – to show how to use the patch safely, discussion about the medication's indications: potency, dose, safety, application, removal, disposal, and signs of toxicity; avoiding heating pads or hot tubs; and removing the old patch before applying a new one. Because there was no common size or shape to the transdermal patch design, and the overlays were clear or skin-toned, the products can be very difficult to see. Besides many patches also had different instructions for placement and suggest rotation on the skin.

A patient may have a fear of becoming addicted to the medication. It was noted that fear of addiction may result in undertreatment of pain. Nurses should know that only a small percentage of patients actually became addicted.

4.1.6 Patient guidance of transdermal medication use

Nurses were the front line providers in patient education and safety. They can assist patients in correct use of opioid medications. The nurses can educate them about home safety especially related to storage of the medication. Nurses can also teach about addiction potential and adverse effects. They should make sure that the patients were aware that any vasodilation and vascularization in the patch area influenced absorption of the medication. For example, a heating pad or hot water bottle over the patch increased the rate of medication absorption. Most commonly patients were advised to place the patch on the torso or trunk of

the body between the neck and the waistline, to scrotal tissue, or the skin behind the ear or the upper arm, and that the patch was applied to clean, dry and hairless skin.

Patient precautions included signs and symptoms of overdose, techniques for applying the patches, and use of other mediations while using the transdermal patches. Patches should not be flushed into the public sewer system because there was a risk for havoc in the plumbing, sanctioned as a safe disposal method by the Environmental Protection Agency in the USA.

4.2 Risks in the administration of transdermal medications

4.2.1 Medication errors by patients in use of transdermal medications

All transdermal patches had the potential for significant harm if used inappropriately. In the articles several cases were mentioned about medication errors. For example, while a nurse took the medication history of a patient who was admitted to the hospital, the patient neglected to mention the fentanyl patch that she was wearing. A physician ordered fentanyl with additional morphine. The result was an overdose of fentanyl. In another case, upon admission assessment four nitroglycerine patches were discovered on the patient on top of one other and the previous patches were not removed. The caregiver did not understand that the patch must be applied directly to the skin to be effective. There were reports of patients who applied the adhesive overly without first applying the patch containing the medication. An overdose can also take place when a patient put fentanyl patches on the skin "wherever it hurt" – the patient had applied six fentanyl patches in all. In a similar event, patient died when his wife applied six fentanyl patches to his skin all at once, failing to remove older patches. It was also noted about a patient who placed the patch on the skin with adhesive tape but never removed the protective paper or plastic. The result was that the patient became underdosed.

A trend related to transdermal patch administration of fentanyl was noticed. Adverse reactions were reported in patients whose fentanyl patches fell of with an unknown duration of therapy, the result was that patients experienced opioid withdrawal. Some patients were found with multiple expired patched that were placed on different days.

4.2.2 Overdose and abuse of transdermal fentanyl

Multiple headlines in resent years identified the dangers of opiate abuse and deaths from overdoses. Fentanyl patch was intended for opiate-treated, opiate tolerant patients with significant chronic pain. Overdose of a fentanyl patch occurred if the patient used more then the prescribed dose, if body temperature reached 40 degree, or the patient's skin was exposed to a direct heat sources. Abuses include patients extracting medication from the patch

then injecting or swallowing it, applying multiple patches or mixing the extracted medication with heroin. In abuse situations the medication was delivered by intravenous injection of patch contents, oral or transmucosal application. In order to enhance and hasten medication absorption heat was applied to the patch. Medication can also be delivered by volatilization and inhaled of the steam and/or consumption of the liquid.

Most of the fentanyl overdose victims die from the direct toxic effects. An uncommon misuse of a patch was mentioned: chewing and followed by complications of aspiration of the patch in combination with other illicit drugs caused death. Fentanyl was rapidly absorbed orally because the oral mucosa was thin and non-keratinized.

Individuals who abused prescription medications may modify the route of administration from the intended method in order to obtain a more rapid "high". The desired effect of achieving euphoria from a sustained-release product such as fentanyl patch required just such modification, because the intended delivery was very slow. Method such as chewing was particularly dangerous as they mechanically disrupted the patch, unleashing a full dose in a short period of time. An example of an accidental ingestion was fatal fentanyl intoxication after the ingestion of a patch by a 1-year-old child.

4.2.3 Prevention of medication errors by prescribers in administration of transdermal medication

Specific prescribing and dispensing guidelines should be developed for prescribers or pharmacists. Fentanyl patches should only be for patients who were opioid-tolerant, with chronic pain, not well controlled with shorter-acting analgesics. Equianalgesic conversion tables could be used to help in changing doses.

The pharmacist should determine the medication's indication in order to ensure that patient was opioid-tolerant and had chronic pain. The pharmacist should question the order if the patient is opioid-naïve or the patch was intended to treat short-term, intermittent or post-operative pain.

Setting dosing limits could prevent medication errors. The patch should be prescribed at the lowest dose needed. No more than 25 mcg/hour of fentanyl should be prescribed as a first-time dose. Prescribers should also take into consideration any other opioids that have been ordered for the patient. Finally, it was noted that it could be prudent to restrict the prescribing of fentanyl patches by limiting prescribing privileges only for prescribers who were educated about the medications.

Indications for transdermal medication administration Planning the transdermal medication administration Assessment of the transdermal medication use Documentation of the transdermal medication administration Staff education for the transdermal medication administration Patient guidance of transdermal medication use	Staff and patient education in the administration of transdermal medications
Medication errors by patients in use of transdermal medications Overdose and abuse of transdermal fentanyl Prevention of medication errors by prescribers in administration of transdermal medication	Risks in the administration of transdermal medications

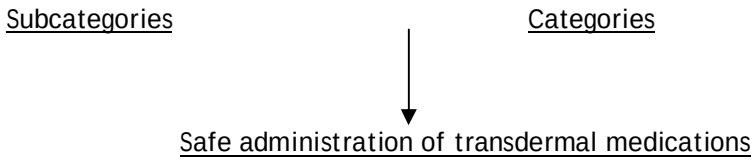

Figure 2: Shows the findings of the study.

5 Discussion

5.1 Ethics and trustworthiness

Researches are unconditionally responsible for the honesty of the research process. The power to produce knowledge requires responsibility for honesty in the production. (O'Leary, 2004, 50)

The German sociologist Max Weber pointed out that all research is contaminated to some extend by the values of the researcher. Only through those values do certain problems get identified and studied in particular ways. The conclusions and implications to be drawn from a study are largely grounded in the moral and political beliefs of the researcher. (Silverman, 2000, 200)

According to Silverman (2000, 201) ethical dilemmas can be avoided by deciding what is the purpose of the research, examining which individuals or groups might be interested or affected by the research, and considering what are the implications for these parties of framing the research topic in the way it is done.

Trustworthiness is an essential component of qualitative research. Findings should reflect the reality of the experience. In qualitative research four issues of trustworthiness demand attention: credibility, transferability, dependability, and conformability. "Credibility is an evaluation of whether or not the research findings represent a credible conceptual interpretation of the data drawn from the participants' original data. Transferability is the degree to which the findings of this inquiry can apply or transfer beyond the bounds of the project. Dependability is an assessment of the quality of the integrated processes of data collection, data analysis, and theory generation. Conformability is a measure of how well the inquiry's findings are supported by the data collected". (Lincoln & Guba, 1985, 296)

The data in this thesis comes from medical journals. The articles have been critiqued and reviewed before publication. Therefore the data which was collected for the literature review can be seen trusted. Ethical considerations were taken into account by accurately analyzing and reporting the findings of selected articles avoiding bias as much as possible. References from the included articles were reported in the text and the list of references was done accurately according to Laurea's thesis guidelines. The principle of transparency was considered by showing the steps of the process for writing the literature review.

Many of the articles which related to the subject and which were from the selected databases were not full text article. One of the limitations for this systematic literature review also was

that the sample of included articles was small to allow generalization of the subject. A limitation of the review was that only two of the articles described nurses' safe practice recommendations about use of transdermal medications. The same articles had patient education mentioned but sufficient details were missing (Paparella, 2005 and Grissinger, 2010). One article emphasizes the role of a nurse in patient education (Cranwell-Brice, 2007), and another one describes the role of a pharmacist (Fan & Elgourt, 2008). Carson, Knight & Garg wrote about abuse of transdermal patches but there was nothing about patient education/guidance.

5.2 Discussion of the findings

According to Safe pharmacotherapy (Publications of the Ministry of Social Affairs and Health 2009, 41-46) the pharmacotherapy plan is required to cover the pharmaceutical services. The plan also takes account of the role of pharmaceutical services in the guidance and information on medicines. The national guide provides plan for distribution and administration of medicine, patient information and advice, evaluating treatment effectiveness, documentation and information, and monitoring and feedback systems. Safe administration of the transdermal patch requires the general guidelines and principles for pharmacotherapy.

Grissinger (2010, 654) points out that fentanyl transdermal patches are still prescribed inappropriately to treat acute pain. He writes about proper prescribing of fentanyl patches in form of safe practice recommendations. Grissinger (2010, 653) also writes that fentanyl transdermal patches are sometimes prescribed inappropriately to treat acute pain in patients who are not opioid-tolerant. The medication is sometimes prescribed in large doses or in combination with oral or intravenous opioids. Pharmacists have filled fentanyl patch prescriptions without questioning if the dose was correct, and the nurses have applied the patches to patients without recognizing possible prescribing errors.

The nurses are the front-line providers in patient guidance and medication safety. The findings of this literature review are significant in order to point out the important role of the nurses in medication administration including transdermal medications. The nurses are able to reduce errors by communicating and documenting the use of transdermal patches, by becoming familiar with different medications and doses; application, removal and disposal of the patches, and by knowing the signs of toxicity and overdose of transdermal medications. (Paparella 2005, 280)

The findings of this systematic literature review points out that there is a relationship between prescription and administration of transdermal medication. Nurses must be sure that the medication that they are administering is prescribed correctly. They must take the care-

ful medication history, communicate and document the usage of all the medications of current use and become familiar with indications of medications. The nurses should also provide the patients with accurate and comprehensive guidance about how to use transdermal medications in a safe manner; how to apply the patch, and how to store and dispose it in order to prevent misuse and abuse.

A practical application for the safe administration of transdermal medications is that all the patients with this kind of medication should receive education both in practice and in written form: about potency and dose of the medication; application, removal and disposal of the patch; and signs of toxicity and overdose. The practical guidance could include showing a patient how to take off the covering foil and protective plastic, and how to apply the patch on clean, hairless and dry skin. As well as telling about the principles about rotation of the site, and the ideal locations on the body for the patch. They should get a telephone number in case of uncertainty or problems concerning the use of transdermal medications in chronic pain management. There could be a ready printed form in each ward with the pertinent information to be given to patients with transdermal medication.

Because transdermal administration of medication is rapidly becoming a useful alternative to oral medication administration and serious errors continue to occur, there is an urgent need for further research for safe administration of transdermal medications. In order to be able to educate patients about safe medication the nurses must know the principles of appropriate prescribing and proper administration of transdermal patches.

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Appendices

Appendix 1 Table 3

Author and the year of the publication	Name of publication	Purpose of the study	Design of the study	Findings/ Significance to this study
Paparella Susan 2005	Transdermal patches: An unseen risk for harm	To point out how nurses can reduce the misuse of transdermal medications	A column based on reports from the Institute for Safe Medication Practices (ISMP)	The safe practice recommendations for nurses how to reduce transdermal medication errors/The information in the column is significant for this study
Grissinger Matthew 2010	Inappropriate prescribing of fentanyl patches is still causing alarming safety problems	To point out the need for safe practice recommendations for fentanyl transdermal patch prescriptions	A column based on reports from the ISMP Medication Errors Reporting Program (MERP)	The safe practice recommendations help avoid the risk of harm caused by prescribing errors/The information in the column is significant for this study
Cranwell-Bruce Lisa 2007	Update on pain management: New methods of opiate delivery	To point out the importance of nurses role in patient education and safety for different forms of medications including transdermal medications	A literature review	The study gives information about correct administration of the various forms of opioid meds including transdermal medications/There is significance to this study
Fan Teresa and Elgourt Tanya 2008	Pain management pharmacy service in a community hospital	The implementation of a pain management pharmacy service in a community hospital	A case study	The study is about a role of a pain management pharmacist/There is a partial significance to this study
Carson Henry, Knight Laura, Dudley Mary and Garg Uttam 2010	A fatality involving an unusual route of fentanyl delivery: chewing and aspiring the transdermal patch	To report about an abuse of opioid transdermal patch by oral ingestion	A case report	The report gives information about one transdermal patch abuse case/There is partial significance to this study

Table 3: Review of articles where search term combination" Transdermal patch" AND "Patient education" is used.

Appendix 2 Table 4

Author and the year of the publication	Name of publication	Purpose of the study	Design of the study	Findings/ Significance to this study
Zinn Linda 2003	Consultant pharmacists: Saving lives and money	To find out how to assist long term care organizations with drug therapy	Interview with Steve Feldman RPh	Appropriate medication use in the elderly can improve quality and quantity of life/Limited significance to this study
Russo Marc and Wasiak Jason 2007	A clinical snapshot of transdermal buprenorphine in pain management	To point out that transdermal patches have shown to have clinical benefit	A literature review	Transdermal patches give high-level patient acceptability compliance and improved quality of life/Limited significance
Borchgrevink Petter 2010	Long-term low-dose transdermal buprenorphine therapy for chronic non-cancer pain	To compare low dose transdermal buprenorphine with placebo patched for osteoarthritis pain	A double blind placebo-controlled study	Documentation of the possibility to perform a high-quality randomized control trial during a time period that is long enough to give meaningful data/Limited significance
Lawrie Iain and Simpson Karen 2007	Management of pain in the terminally ill	How to provide good pain control in patients with advanced illness	Feature article	Effective pain control requires active multidisciplinary total management with regular review and timely reassessment/Limited significance
Bennett Michael 2005	Management of severe pain in terminal care	To point out importance of proper assessment of patients with cancer pain	Feature article	Management of new pain requires assessment of the cause and treatment of cancer-related pain/Limited significance

Table 4: Review of articles where search term combination ”Transdermal patch” AND “Pain management” are used.